Epidemiology Report

NORTH DAKOTA DEPARTMENT of HEALTH

September – October 2004

In this Issue:

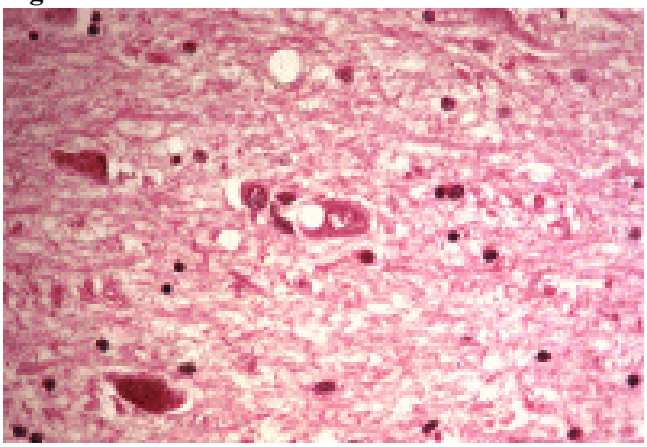
- Transmissible Spongiform Encephalopathies
- Summary of Selected Reportable Conditions

Transmissible Spongiform Encephalopathies

The emergence of bovine spongiform encephalopathy or "mad cow" disease in the United Kingdom (UK) in the mid-1980s redefined food safety measures for the animal feed industry and livestock producers. Although scrapie has been recognized as a degenerative brain disease in sheep and goats since the 18th century, mad cow disease in the UK was the first documentation of a similar disease in cattle **(1)**. The mad cow epidemic peaked in January 1993 at almost 1,000 new cases per week. The outbreak may have resulted from feeding scrapie-containing sheep meat-and-bone meal to cattle and further amplified by feeding rendered bovine meat-and-bone meal to young calves. Feed bans were instituted and borders were closed to exported cattle from affected countries. In the mid-1990s, the anticipated risk to public health transpired. Strong evidence indicates that mad cow disease is transmissible to humans probably by the oral route, causing a variant form of Creutzfeldt-Jakob disease in people. This form of disease was identified in 1996 in the UK and is known as variant Creutzfeldt-Jakob disease (vCJD).

Mad cow disease and vCJD belong to a group of rare and fatal degenerative brain diseases called transmissible spongiform encephalopathies (TSEs) or prion diseases. A prion is an abnormal protein that is believed to be the infectious agent of TSEs. These proteins have become abnormal by undergoing a conformational change **(11, 7)**. The mechanism and site of this shape conversion is unknown. The theory of infectivity from these abnormal proteins involves their ability to multiply by converting normal protein molecules into abnormal ones by inducing the same change in shape **(5)**. The new shape of the now abnormal proteins, or prions, accumulate most often in the central nervous system (CNS) and aggregate and deposit in CNS tissues, such as the brain, resulting in microscopic vacuoles or small holes that give the brain a sponge-like appearance **(Figure 1)**, deriving the term "spongiform."

Figure 1. Creutzfeldt-Jakob disease in a human brain.



Source: The Official Mad Cow Disease Home Page (www.mad-cow.org).

TSEs exhibit biological properties unique from other microbiological diseases **(7)**. Prions are resistant to many disinfectants and tissue fixatives and standard autoclave conditions (121°C for 15 minutes). They are also resistant to high doses of ionizing and ultra violet irradiation and may survive for long periods of time in the environment **(12)**.

There are four TSE diseases that affect humans: Creutzfeldt-Jakob disease (CJD), Gerstmann-Staussler-Schneinker syndrome, kuru and fatal familial insomnia. A brief definition of each condition can be viewed at the website www.cjdsurveillance.com/prion.html. The five animal TSE diseases include scrapie in sheep and goats, transmissible mink encephalopathy, chronic wasting disease (CWD) in dear and elk, feline spongiform encephalopathy affecting domestic cats and bovine spongiform encephalopathy (BSE or "mad cow disease"). Transmissible mink encephalopathy and BSE are feed-borne diseases. Transmission of TSEs to humans has occurred in both human and bovine sources, resulting in

Terry Dwelle, MD, MPHTM
State Health Officer

Craig Lambrecht, MD, MPH
Chief, Medical Services Section

Larry A. Shireley, MS, MPH
Director, Disease Control

Tracy Miller, MPH
Epidemiologist, Editor

Published by the North Dakota Department of Health, Division of Disease Control, 600 E. Boulevard Ave. Dept. 301, Bismarck, N.D. 58505-0200,
Phone 701.328.2378 or in ND 1.800.472.2180.
Publication is available in alternative forms; for more information, contact Editor, *Epidemiology Report.*
Publication also appears on the department's home page at http://www.health.state.nd.us
EQUAL OPPORTUNITY EMPLOYER.

iatrogenic CJD and vCJD, respectively. Other animal TSEs, including CWD and scrapie, are not known to cause human disease.

TSEs are invariably progressive and fatal once clinical signs appear; there is currently no known effective treatment.

Classic CJD vs. Variant CJD

CJD is classified in four forms: sporadic, familial, iatrogenic and the recently described vCJD. Sporadic CJD is a classic form of the disease and is the most common, accounting for 80 to 90 percent of cases **(5)**. This sporadic disease has been recognized since the early 1920s and occurs worldwide with no recognizable mode of transmission. Morbidity occurs at an estimated annual rate of one case per one million people worldwide **(5)**.

CJD is a neurodegenerative disease characterized by rapidly progressive dementia, confusion, muscle twitching, visual disturbances and ataxia **(5)**. The usual age of onset is between 55 and 75 years of age; the median age at death is 68 **(12)**. Most CJD patients die within one year of illness onset. A clinical diagnosis is made on the basis of typical signs and symptoms and progression of the disease and/or association with a typical electroencephalogram. The only confirmative test available is neuropathologic evaluation of brain tissue obtained by biopsy or autopsy **(8)**. It is important for physicians to pursue autopsies of all clinically suspected and diagnosed CJD patients for surveillance and detection of new, emerging prion diseases.

Five cases of classic CJD have been reported in North Dakota since 1994. The ages of the cases ranged from 45 to 62 years with a median age of 54. Eighty percent of the cases were male. All of the cases were fatal; the most recent death occurring in September 2004. To date, none of the cases have been identified as vCJD.

CJD is not known to spread by contact from person to person, but transmission during invasive medical interventions has occurred, referred to as iatrogenic CJD. The first case of iatrogenic transmission of CJD was identified in 1974 in a corneal graft recipient **(7)**. According to the CDC, over 250 iatrogenic CJD cases have been reported worldwide. Cases have been linked to the use of contaminated human growth hormone, dura mater and corneal grafts or neurosurgical equipment. Routine use of CJD infection control guidelines developed by the World Health Organization for health-care workers involved in the care of CJD patients has prevented further occurrence of iatrogenic CJD.

Variant CJD was first described in 1996 in the United Kingdom **(3)**. Evidence indicates that the cause of vCJD is the same prion that causes BSE in cattle, transmitted to humans via consumption of BSE-contaminated cattle products **(5,7)**. Variant CJD is the only known human TSE that is transmitted from another species.

Cases of vCJD can be distinguished from classic CJD on the basis of clinical and pathologic data **(Table 1)**. The median age at death for vCJD patients is 28 years, compared with 68 years for patients with classic CJD. In addition, all vCJD cases have neuropathologic findings distinctly different from those of classic CJD. With the extensive involvement of lymphoid tissues and the central nervous system unique to vCJD, the possibility of iatrogenic disease transmission of vCJD by contaminated surgical instruments or by blood transfusion is a public health concern **(3, 10)**.

Table 1. Clinical and pathologic characteristics distinguishing vCJD from classic CJD (5)

Characteristic	vCJD	Classic CJD
Median age at death	28 years	68 years
Median duration of illness	13-14 months	4-5 months
Clinical signs and symptoms	Prominent psychiatric/behavioral symptoms; painful dysesthesias; delayed neurologic signs	Dementia; early neurologic signs
Periodic sharp waves on electroencephalogram	Absent	Often present
"Pulvinar sign" on MRI[†]	Present in > 75% of cases	Not reported
Presence of "florid plaques" on neuropathology	Present in large numbers	Rare or absent
Immunohistochemical analysis of brain tissue	Marked accumulation of PrP^{res}[§]	Variable accumulation
Presence of agent in lymphoid tissue	Readily detected	Not readily detected
Increased glycoform ratio on immunoblot analysis of PrP^{res}	Present	Not present
Genotype at codon 129 of prion protein	Methionine/methionine	Polymorphic

[†]High signal in the posterior thalamus
[§]Protease-resistant prion protein.

In 1996, because of the emergence of vCJD in the United Kingdom, the U.S. Centers for Disease Control (CDC) enhanced surveillance for CJD in the United States. As of Dec. 1, 2003, a total of 153 cases of vCJD have been reported in the world. Ninety-three percent (143) of the reported cases of vCJD are from the United Kingdom, six from France and one each from Canada, Ireland, Italy and the United States. Cases reported in Canada, Ireland and the United States had a history of previously living in the United Kingdom during a key exposure period of the U.K. population to the BSE agent. Information about the vCJD patient identified in the United States is available at www.cdc.gov/mmwr/preview/mmwrhtml/mm5141a3.htm.

Free Diagnostic CJD Services to U.S. Physicians

CDC, in collaboration with the American Association of Neuropathologists, established the National Prion Disease Pathology Surveillance Center at Case Western Reserve University, Cleveland, Ohio, in 1996 and 1997. This pathology center provides free, state-of-the-art diagnostic services to U.S. physicians. It also helps to monitor the possible occurrence of emerging forms of prion diseases, such as variant CJD, in the United States. For more information about the center, visit www.cjdsurveillance.com/.

Bovine Spongiform Encephalopathy

Bovine spongiform encephalopathy (BSE) or "mad cow disease" was first confirmed in the U.K. in 1986 **(3, 7)**. One accepted theory is that BSE derived from feeding rendered carcasses of livestock and sheep to ruminants as a protein supplement **(3)**. Ruminants are animals that chew their cud, such as cattle, sheep, goats, deer, elk and bison.

BSE cases have continued to decline since they peaked in 1992 and 1993 **(7)**. The decline is the result of successive bans on feeding ruminant-derived protein and mammalian meat-and-bone meal to ruminants regulated by the U.S. Food and Drug Administration. Information about the feed ban and a list of prohibited animal protein products is available at www.fda.gov/cvm/default.html.

Through the end of November 2003, nearly 200,000 cases of BSE were confirmed in the U.K **(3)**. Cattle infected with BSE are unsteady on their feet, lose weight and act nervous. There is no treatment or prophylaxis and the disease is invariably fatal. BSE has been identified in several other countries, either indigenous or following export from countries with BSE. Countries reporting positive BSE cattle can be viewed at www.oie.int/eng/info/en_esb.htm.

The first case of BSE in the United States was confirmed on Dec. 25, 2003 **(4)**. The dairy cow from Washington state was nonambulatory at the time of slaughter. The cow was examined by a U.S. Department of Agriculture (USDA) Food Safety and Inspection Service (FSIS) veterinary medical officer both before and after slaughter. The carcass was released for use of food for human consumption and brain tissue samples were sent in for testing as part of the USDA's Animal and Plant Health Inspection Service (APHIS) targeted BSE surveillance. After preliminary test results on Dec. 3, 2003, indicated the cow was positive for BSE, FSIS recalled beef from cattle slaughtered in the same plant on the same day as the BSE-positive cow. APHIS later traced the birth of the BSE-positive cow to a farm in Alberta, Canada.

Emergence of BSE in the United States prompted the USDA to adopt public health measures to protect human consumers against vCJD **(5) (Box 1)**. Slaughter methods that could be responsible for contamination of beef products by CNS tissue are now restricted or prohibited by the USDA.

Box 1. Safeguards proposed by the USDA to minimize the risk for exposure to the BSE agent – United States, Dec. 30, 2003 (4)

- USDA's FSIS has announced an immediate ban on the use of nonambulatory disabled ("downer") cattle for human food consumption.
- FSIS inspectors will not mark cattle carcasses tested for BSE as "inspected and passed" until negative test results are received.
- FSIS will prohibit the use in the human food supply (including advanced meat recovery [AMR]*) of "specified risk material" (i.e., high-risk materials), including the skull, brain, trigeminal ganglia, eyes, vertebral column, spinal cord and dorsal root ganglia of cattle age $\geq$ 30 months and the tonsils and small intestine of cattle of all ages.
- FSIS also will prohibit the presence of brain, spinal cord, trigeminal ganglia and dorsal root ganglia from cattle age < 30 months in meat produced by AMR.
- To reduce the risk that portions of the brain are not dislocated into the tissues of the carcass as a consequence of stunning cattle before slaughter, FSIS will ban air-injection stunning.
- FSIS will prohibit the use of mechanically separated beef† in the human food supply.

* An industrial process that removes muscle tissue from the bone of beef carcasses under high pressure without incorporating bone material when operated properly; product may be labeled as "meat."

†A meat food product that is finely ground to a paste- or batter-like consistency and that results from the mechanical separation and removal of most of the bones from the attached skeletal muscle of cattle carcasses and parts of carcasses; may not be labeled as "meat" but rather as "meat food product."

Rapid screening tests for BSE are now approved in the United States and enhanced surveillance by increased BSE testing was launched by APHIS in June 2004. Animals that are targeted for enhanced surveillance are nonambulatory cattle, cattle exhibiting signs of a central nervous system disorder or other signs that may be associated with BSE, cattle condemned at slaughter and cattle found dead on the farm. All animals suspected of having BSE are slaughtered and destroyed.

To enhance the speed and accuracy of the response to animal health threats such as BSE, APHIS is working to implement a national identification system to track animals of various species through the livestock marketing chain **(4)**. The goal of the national identification system is to trace back BSE-positive cattle within 48 hours after its discovery. Information about the United States Animal Identification Plan can be viewed at usaip.info/.

Chronic Wasting Disease

Chronic wasting disease (CWD) of white-tailed deer, mule deer and Rocky Mountain elk was first described in the United States in the 1960s **(6)**. CWD has spread in free-ranging deer or elk from the previously endemic areas of northeastern Colorado and southeast Wyoming to Colorado, Nebraska, Saskatchewan, South Dakota, Wisconsin, Illinois, New Mexico and Utah **(Figure 2)**. CWD has also been found in farmed deer or elk herds in Colorado, Wyoming, South Dakota, Montana, Nebraska, Kansas, Oklahoma, Minnesota, Wisconsin, Saskatchewan and Alberta **(Figure 2)**. Because of increasing detection of CWD in a wider geographic area and the presumed foodborne transmission of BSE to humans, concern has raised about the possible zoonotic transmission of CWD **(2)**.

CWD is a transmissible prion disease with prolonged incubation periods, typically 12 to 18 months. Clinical signs of the disease include excessive salivation, difficulty swallowing, loss of appetite, progressive weight loss, and excessive thirst and urination **(2)**. The animals become emaciated and display abnormal behavior, lose coordination, become weak and eventually die.

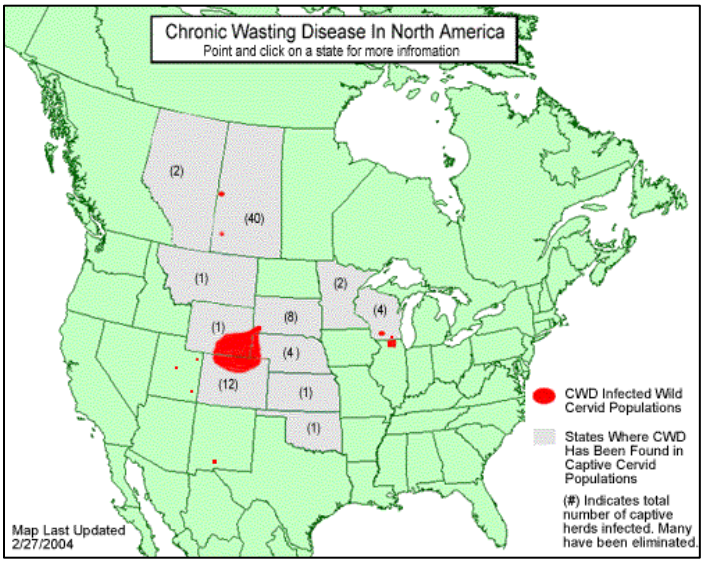
CWD can be transmitted to susceptible animals indirectly, from environments contaminated by feces or decomposed carcasses **(9)**. Direct transmission from interaction with infected animals also may be possible. The risk of transmission to humans via consumption of contaminated meat is low and no human case of prion disease linked to CWD has been identified **(2)**. However, transmission of BSE to humans and the resulting vCJD indicates that the species barrier may not completely protect humans from animal prion diseases.

The North Dakota Game and Fish Department (NDGFD) conducts surveillance throughout the state, including recognition, collection and submission of samples from wild deer and elk. Diagnosis of CWD is confirmed by microscopic examination of the brain stem, tonsil or lymph node of the animal after death. Hunter-harvested deer in selected surveillance areas and farmed elk and deer herds also are monitored to track disease incidence, prevalence and trends. In 2003, a total of 1,612 samples from deer and 29 samples from elk submitted by North Dakota hunters were tested for CWD with no positives identified. This year, a total of 1,917 samples from deer and 17 samples from elk are being tested for CWD. To date, 14 elk from the early season have tested negative and the rest of the samples are pending.

To minimize risk of exposure to CWD, hunters should consult with the NDGFD to avoid areas where CWD has been identified. Hunters should avoid eating meat from deer or elk that look sick or test positive for CWD; wear gloves when field-dressing carcasses; bone-out the meat from the animal and minimize handling of brain and spinal cord tissues; avoid eating high-risk deer and elk tissues, such as brain, spinal cord, eyes, spleen, tonsil and lymph nodes, and abide by guidelines established in the 2004 deer and elk carcass importation proclamation regulating the transportation and importation of deer or elk carcass or carcass parts into North Dakota from areas within states or provinces with documented occurrences of CWD.

Frequently asked questions about CWD and information about surveillance efforts and locations can be viewed on the North Dakota Game and Fish Department website at www.state.nd.us/gnf/info/cwd-q-and-a.html.

Figure 2. Chronic Wasting Disease in North America.



Click the picture for state-specific information.
Source: ©Chronic Wasting Disease Alliance

Summary of Selected Reportable Conditions					
North Dakota, 2003-2004					
Reportable Condition	**September - October 2004***	**January-October 2004***		**September - October 2003**	**January-October 2003**
Campylobacteriosis	6	101		11	72
Chlamydia	328	1597		287	1324
Cryptosporidiosis	0	10		1	13
E. coli, shiga toxin positive (non-O157)	0	6		0	4
E. coli O157:H7	2	14		5	14
Enterococcus, Vancomycin-resistant (VRE)	7	14		3	16
Giardiasis	3	21		10	42
Gonorrhea	20	103		30	84
Haemophilus influenzae (invasive)	1	4		2	5
Hepatitis A	0	1		1	2
Hepatitis B	0	4		0	2
HIV/AIDS	2	16		2	18
Legionellosis	0	2		0	1
Lyme Disease	0	0		0	0
Malaria	0	3		0	1
Meningitis, bacterial[1] (non meningococcal)	1	7		1	4
Meningococcal disease	0	2		0	1
Mumps	0	1		0	0
Pertussis	79	700		1	7
Q fever	0	0		0	1
Rabies (animal)	5	54		6	53
Salmonellosis	4	40		7	39
Shigellosis	0	3		1	7
Staphylococcus aureus, Methicillin-resistant (MRSA)	182	1193		231	1132
Streptococcal disease, Group A[2] (invasive)	1	11		1	16
Streptococcal disease, Group B[2] (infant < 3 months of age)	0	0		2	5
Streptococcal disease, Group B[2] (invasive[3])	4	36		9	30
Streptococcal disease, other[2] (invasive)	3	13		3	12
Streptococcal pneumoniae[2], (invasive, children < 5 years of age)	1	3		3	7
Streptococcal pneumoniae[2] (invasive[4])	5	46		15	55
Streptococcus pneumoniae[2], drug-resistant	0	0		0	3
Tuberculosis	1	4		3	6
West Nile Virus Infection	3	20		143	617

*Provisional data

[1] Meningitis caused by *Staphylococcus aureus* and *Streptococcus pneumoniae.*

[2] Includes invasive infections caused by streptococcal disease not including those classified as meningitis.

[3] Includes invasive infections of streptococcal, Group B, disease in persons ≥ 3 months of age.

[4] Includes invasive infections caused by *Streptococcus pneumoniae* in persons ≥ 5 years of age.

References

1. Adams D, Lasmezas, CI. Risk Analysis of Prion Diseases in Animals. Emerging Infectious Diseases 2004; 10(6):1177-1178.
2. Belay E, Maddox R, Williams E, Miller M, Gambetti P, Schonberger L. Chronic Wasting Disease and Potential Transmission to Humans. Emerging Infectious Diseases 2004; 10(6):977-984.
3. Brown P, Will R, Bradley R, Asher D, Detwiler L. Bovine Spongiform Encephalopathy and Variant Creutzfeldt-Jakob Disease: Background, Evolution and Current Concern. Emerging Infectious Diseases 2001; 7(1):6-16.
4. CDC. Bovine Spongiform Encephalopathy in a Dairy Cow – Washington State, 2003. MMWR 2004; 52(53):1280-1285.
5. CDC. Creutzfeldt-Jakob Disease Not Related to a Common Venue – New Jersey, 1995-2004. MMWR 2004; 53:1-4.
6. CDC. Fatal Degenerative Neurologic Illnesses in Men Who Participated in Wild Game Feasts – Wisconsin, 2002. MMWR 2003; 52(7):125-127.
7. European Advisory Committee on Dangerous Pathogens, European Spongiform Encephalopathy Advisory Committee. Transmissible Spongiform Encephalopathy Agents: Safe Working and the Prevention of Infection, June 2003. Available at http://advisorybodies.doh.gov.uk/acdp/tseguidance.
8. Louie J, Gavali S, Belay E, Trevejo R, Hammond L, Schonberger L, Vugia D. Barriers to Creutzfeldt-Jakob Disease Autopsies, California. Emerging Infectious Diseases 2004; 10(9):1677-1680.
9. Miller M, Williams E, Hobbs T, Wolfe L. Environmental Sources of Prion Transmission in Mule Deer. Emerging Infectious Diseases 2004; 10(6):1003-1006.
10. Peden AH, Ironside JW. Review: Pathology of Variant Creutzfeldt-Jakob Disease. Folia Neuropathologica 2004; 42 Suppl A: 85-91.
11. Perini F, Vidal R, Ghetti B, Tagliavin F, Frangione B, Prelli F. PrP27-30 is a Normal Soluble Prion Protein Fragment Released by Human Platelets. Biochemical & Biophysical Research Communications 1996; 223:572-577.
12. World Health Organization. WHO Infection Control Guidelines for Transmissible Spongiform Encephalopathies: Report of a WHO Consultation, 1999. WHO/CDS/CSR/APH/2000.3. Available at http://www.who.int/emc-documents/tse/whocdscsraph2003c.html.

Contributing Authors:
Erin Fox, surveillance epidemiologist
Julie Goplin, surveillance epidemiologist